

Northeastern Forest Experiment Station

Upper Darby, Pa.

QUARTERLY REPORT ON

FOREST INFLUENCES AND FLOOD CONTROL SURVEYS

April 1, 1951



FOREST INFLUENCES

GENERAL

by H. C. Storey

During the past quarter a Division of Forest Influences was established at this Station. Storey was appointed chief of it.

With the increasing recognition of the importance of watershed management to the Northeast the need for forest-influences research has become more and more evident. In response to this need, the Station has undertaken a number of influences-research projects at several of the research centers. Establishment of the new division will insure the proper correlation of influences-research projects, will assist in making research results currently available, and will assist in starting new projects as needed.

It is felt that the Station's research program has been greatly strengthened, and the Station is now better able to supply the research needs of the region.

Soil Freezing Study

The soil freezing study described briefly in the last Bi-Monthly report is yielding some very interesting data. Although the data will not be analyzed until the coming summer, an examination of the observations indicates certain relationships.

In general, plots in open-land conditions started having concrete frost sooner than forest-land plots and have frozen concretely to greater depths. Within the forest-land plots, more concrete frost and deeper freezing has occurred in coniferous stands than in comparable hardwood stands. Plots in the younger-age-class stands have more concrete frost than the older stands; thus, seedling-sapling stands have more concrete frost than pole stands, which in turn have more ~~saw~~ saw-timber stands. Disturbance or

destruction of the forest floor may have a considerable effect upon the occurrence of concrete frost. A light cutting operation with a minimum of disturbance to the forest floor appears to have little effect upon the incidence of concrete frost; areas that have been grazed tend to have more concrete frost than undisturbed areas of the same type and stand size class, the degree of difference depending upon the intensity of grazing. Destruction of the forest floor by fire results in a great increase in the incidence of concrete frost.

DELAWARE BASIN RESEARCH CENTER

by Irvin C. Reigner and Nedavia Bethlahmy

Weather

Precipitation for the present hydrologic year has been abnormally high so far. The 5-month total from October 1, 1950, through February 28, 1951, amounts to 28.34 inches as compared with 20.68 and 17.93 inches as recorded during the same months in water-years 1949 and 1950. Generally, rainfall in this locality is well distributed throughout the year; however, this 5-month total is more than 60 percent of the expected 45 inches of annual precipitation. Rainfall in November set a high monthly record with 8.46 inches, being 1.24 inches greater than the previous monthly high recorded in May 1949.

Ground Water

As a direct result of the record rainfall in November, ground-water storage reached record highs. One of the two indicator wells peaked immediately following the Thanksgiving Day storm, while the other well reached its peak on December 9. Water in the latter well rose to within 1 foot of the ground surface, nearly 3 feet higher than the previous high.

A recent news item commented on the effect of last year's earthquake in Assam, India, on the level of water in a well in Texas. Investigation revealed that large distant earthquakes (India, British Colombia, Italy) affected the ground-water level at wells in our own experimental forest. The effects were in some cases permanent, i.e., either a permanent rise or fall in the level of the ground water. The U.S.G.S. was notified of these facts. They are apparently making a continuing study of this phenomenon. The U. S. Coast and Geodetic Survey now informs us regularly concerning the occurrence of earthquakes, and in turn, we inform the U.S.G.S. of any changes that occur in our well hydrographs.

Soils

Soil-moisture tabulations were completed for all the soil moisture sites at Dilldown. These tabulations list the inches of water contained in a given soil horizon when a given resistance is encountered on the Colman meter. These tables are now being used to analyze the soil-moisture resistance data that have been taken at Dilldown.

A soil map of Dilldown was completed. We are now able to assign weights to the soil-moisture data on the several sites in order to determine the average soil moisture stored in the watershed.

The soils map shows the following distribution of soils, water surfaces, and road area within the Dilldown watershed.

	<u>Percent of area</u>
Dekalb stony sandy loam	- 69
Dekalb sandy loam	- 12
Upshur loam	- 6
Swamps (clay loam)	- 8
Boulder fields and streams	- 4
Roads	- 1

Soil-Moisture Losses

The computation of soil-moisture losses and an attempt to correlate these losses with climatic data has been a major project during the quarter.

It is now possible to compute losses in soil moisture at Dilldown watershed following the complete calibration of the Colman soil-moisture units. Changes in soil-moisture storage reflect additions of moisture by precipitation and losses due to gravitational drainage, transpiration, and evaporation.

During those periods between storms when soil moisture has dropped to field capacity or below, further losses are due to evaporation and transpiration and can be directly measured in inches of water.

If soil-moisture measurements were made daily, the loss in soil moisture from one day to the next is obtained. In certain cases, resistance readings were taken at longer intervals, in which case a periodic loss is obtained. These periods ranged from 2 to 4 days.

In order to determine daily soil-moisture losses, an attempt was made to correlate known soil-moisture losses with several climatic factors. The factors studied were: temperature and humidity (expressed as saturation deficit), wind velocity, moisture content of the soil, and a time-precipitation ratio which takes into account the time interval between the last storm

of more than 0.02" and the day in question, and the size of the last storm. Statistical analysis for losses during the summer months showed that only two factors were significant: the time-precipitation ratio and the saturation deficit. The regression equation is:

$$L = 0.041 + 0.087T_p + 0.391S_d$$

in which L = Loss in soil moisture in inches per day; T_p = number of hours since the last storm greater than 0.02" divided by 1000 times the amount of precipitation for the storm in inches; S_d = saturation deficit (calculated by averaging the S_d every two hours). Further work may change somewhat the value of the regression coefficients.

This equation will be used to compute evapo-transpiration losses during periods when soils are above field capacity and changes in soil moisture include drainage as well as evapo-transpiration losses. When the vegetation has been converted to a timber stand, the equation will be used, by comparison with measured losses, to evaluate the change in evapo-transpiration losses due to the vegetation change.

Interception and Stemflow

Data on interception and stemflow in scrub oak cover, obtained from measurements taken last summer, have been analyzed. Net interception was found to have a close relationship to size of storm, allowing the computation of the following equation:

$$I = 0.025 + 0.032 P$$

in which I = net interception per storm in inches; P = total precipitation per storm, also in inches.

The above relationship closely follows relationships determined previously in chaparral brush types in California.

Vegetation Survey

An intensive survey of the vegetation on the watershed is planned for the forthcoming field season. An attempt will be made to delineate each feature of the vegetative cover which may have a differing effect on the water relations of the watershed. For example, the transpiration rate of the scrub oak may differ from that of other species; a dense cover will intercept more precipitation than a sparse cover. Thus, the position and areal extent of each distinct category must be known. A work plan for the survey has been prepared in rough draft.

Scrub Oak Conversion

As part of the continuing search for improved methods of site prep-

aration preceding planting in scrub oak lands, a demonstration of the Seaman Tiller was held at Dilldown last October. The demonstration was reported in the recent Winter issue of Pennsylvania Forests.

Results were so promising that the Pennsylvania Department of Forests and Waters has planned an experiment using the Seaman Tiller. Approximately eight acres of scrub oak land adjoining the watershed area have been laid out for treatment and subsequent planting. To date, weather conditions have not allowed operation of the Tiller but the site treatment will proceed as soon as the frost has gone.

Manuscripts

Reigner revised the report on Sedimentation in the Schoharie Reservoir, and sent in his comments on a similar report submitted by the S.C.S.

Bethlahmy submitted the following manuscripts for possible publication:

How Deep is a Deep Soil--an article proposing that the depth of soils be classified in accordance with the relation of the soil's reservoir capacity to the monthly rainfall during the warm season.

A method to Determine the Water Content of Soils--an article giving in detail the methods which were used at Dilldown in completely calibrating the Colman units.

Why Do Plants Wilt in Cold Weather--an article pointing out that one of the main reasons for the wilting of plants during freezing weather may be the unavailability of soil moisture.

The manuscript "Forest and Water Research at the Delaware-Lehigh Experimental Forest" prepared by Storey, has been forwarded to the Pennsylvania Department of Forests and Waters for publication.

Miscellaneous

Storey and Bethlahmy attended the Golden Anniversary Meeting of the Society of American Foresters held at Washington, D. C., December 14-16.

Eugene McNamara, recent Penn State graduate, has been hired as research forester by the Pennsylvania Department of Forests and Waters. One of Mac's main duties is to work closely with us on the Dilldown project.

John J. Coughlin, former student summer assistant, has been rehired following his graduation in Conservation at Lehigh University.

MOUNTAIN STATE RESEARCH CENTER

by George R. Trimble, Jr.

Fernow Experimental Forest

Watersheds.—Precipitation measurements were begun in February. Fifteen standard rain gages and three recording gages were installed over the five gaged watersheds. It is expected that eventually the number of gages in this network can be reduced without loss of accuracy because: (1) the total area of the five watersheds is only about 360 acres; (2) the watersheds are contiguous; (3) the topography is similar, i.e., steep mountainous country with elevations running from 2,200 to slightly over 2,800 feet. Observations to date show relative insignificant differences in precipitation catch, but of course no observations have been made on summer storms where greater differences would be expected.

Reduction in the number of gages will effect a big savings in time, especially in the field. At present it requires 6 hours to service these gages for every storm since the watersheds are relatively inaccessible and a large part of the road system is not passable in bad weather.

Water-level recorders and reference bars have been installed at four of the five stilling basins. Recording of stream-flow data will start on April 1 for these areas—a month before the beginning of the growing season. Some work still remains to be done on the fifth stilling basin but it will be in operation by April 15.

Skid-road erosion study.—An informal study to determine trends in skid-road erosion was started 2 years ago following logging of four 5-acre plots. Each plot was logged under a different cutting-practice level with different intensities of cutting and different road location and drainage standards. A comparison of changes in road cross sections for several years following logging will provide an estimate of the effects of these different cutting-practice levels on soil movement in skid roads.

The annual remeasurement of these cross sections has been completed and the data are being computed. In addition to remeasurement of the cross sections, the percent slope and the distance from each cross section to the nearest water bar above was measured. These measurements may give an indication of the effect of slope and of distance on the amount of soil moved in skid roads.

Trips

Trimble spent a 2-week in-service training period at Coweeta.

Visitors

Bernard Frank spent several days "on vacation" here. With Mrs. Frank, he hiked over a good part of the Fernow. He saw our watershed installations and watched the logging operations. We enjoyed and profited from our discussions with Bernie.

FLOOD CONTROL SURVEYS

by Arthur Bevan

GENERAL

Precipitation during the period averaged about 30 percent above normal for the Northeastern region. However, snow cover has been light and considerably below normal except in the Adirondacks where it was about normal during the earlier part of the winter.

Runoff, on the other hand, has been about normal except in New York, Pennsylvania, and West Virginia where stream flow has been well above normal.

Flood stages occurred in many streams during February in these states due to rainfall and melting snow. Flood damage, however, was light. At the end of March a tropical storm with heavy precipitation caused severe and extensive floods in New York, New Jersey, New England, and Pennsylvania. Northern New Jersey in the Passaic and Raritan watersheds was the most seriously affected and suffered heavy damage and some loss of life.

An ice jam on the Susquehanna River near Columbia, Pa., in February caused evacuation of many families, flooded the local water plant, and closed all factories for a period of 10 days.

The soil freezing studies being carried out in the New England-New York area are producing some very interesting results. The winter started out with very cold weather and little snow cover so that soil freezing was extensive. This condition has continued throughout most of the winter. In general, soil freezing started from the 1st to the 15th of December. Formation of concrete frost started first in all types of open land followed by clear cut forest areas and abandoned farm land reverting to forest. About January 1, concrete frost was found in most coniferous stands but depths were generally less than found on any type of open land. By the end of January concrete frost was found in hardwood stands, depths reached 1 or 2 inches but was patchy with a minimum of the concrete type. Concrete frost during February reached the maximum development. All open land contained concrete frost exceeding 10 inches depth. Concrete frost was found quite generally in all forest stands but averaged considerably less than on open lands.

Depending on the study location, considerable differences in thawing of concrete frost occurred. In some all frost disappeared from forest areas during March and was only observed in open lands. In central New York concrete frost started to thaw in open lands and by the end of March a large part of the frost had gone, whereas concrete frost still existed in the forest, particularly coniferous stands.

SURVEY ACTIVITIES

The tentative draft of the Merrimack Report is about completed. Work has been started on a draft of the Salt River (Ky.) report. Hydrologic analysis, development of the recommended program, and costs are about finished.

A work outline of the flood control surveys to be conducted in the New England-New York area is under way. A start has been made on work plans to guide the surveys in the selected watersheds. The collection and tabulation of existing data for land use inventories is proceeding and has been largely completed on the New York and Maine Rivers areas.

STATUS OF FLOOD CONTROL SURVEYS

Connecticut River.--Still in the Washington Office.

Merrimack River.--Tentative draft nearing completion.

Allegheny River.--No further progress.

Salt River.--Analysis and development of recommended program and costs nearing completion. Start made on rough draft report.

COOPERATION WITH SOIL CONSERVATION SERVICE

Delaware River report concurred in by Station. Submitted to Washington.

Youghiogheny River report reviewed and concurred in by Station. Being mimeographed for submission to Washington.

Lower Susquehanna River. All forestry phases of report completed and submitted to S.C.S.

Roanoke River report. Review by Forest Service completed and comments submitted to S.C.S.

A preliminary examination report and work outline for Cattaraugus and Smoke Creeks (Pa.-N.Y.) has been reviewed and concurred in by the Station.

PERSONNEL

Tom Clark has transferred from Flood Control, Northeastern Station to the Green Mountain National Forest in charge of S.A.B. work.

Bert Husch has joined the Flood Control staff reporting March 12.

MEETINGS

Meetings of the New England-New York Inter-Agency Committee at Boston and Hartford were attended by several members of the Station staff. J. C. Rettie has been appointed Departmental representative on the Flood Control Working Group. Norman Tripp is his alternate.

Don Whelan has been appointed Departmental representative on the Hydrology Subcommittee of NENYIAC. He attended the first meeting held in Boston.

Agriculture--Forest Service--Upper Darby